

A REVISION OF THE AFROTROPICAL SPIDER GENUS *PALFURIA* (ARANEAE, ZODARIIDAE)

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ABSTRACT. The African genus *Palfuria* Simon 1910 is revised. The genus now contains nine species: the type species *Palfuria retusa* Simon 1910, described on the base of single juvenile, *P. gibbosa* (Lessert 1936), *P. panner* Jocqué 1991, and six species that are described as new: *P. capulari* (♂ ♀), *P. harpago* (♂), *P. helichrysum* (♀), *P. hirsuta* (♀), *P. gladiator* (♂ ♀), *P. spirembolus* (♂ ♀). The male of *Palfuria panner* is redescribed, and the female described for the first time. Five species (*P. retusa*, *P. spirembolus*, *P. gladiator*, *P. panner*, *P. harpago*) are from the southwestern part of the continent, the other species (*P. gibbosa*, *P. helichrysum*, *P. hirsuta*, *P. capulari*) from the eastern part. The last species is from as far north as northern Tanzania. As in many other genera, there is a tendency for the embolus to increase in length. Both the most basal (*Palfuria panner*) and the most derived species (*Palfuria spirembolus*) are found in Namibia.

Keywords: Cladistic analysis, complexity, new species

Palfuria is a poorly-known genus, recorded only from the southern part of Africa. Its type species (*Palfuria retusa*) was described on the basis of a single juvenile specimen. Both additional described species (*P. gibbosa* and *P. panner*) were each known from one sex only. Since the revision of Jocqué (1991), an important number of specimens representing several new species has become available. The present paper treating these specimens shows that the diagnostic characters identified by Jocqué (1991) remain valid; but there is a lot of variation in genitalic characters and, to a lesser degree, in somatic traits. Scanning electron micrographs of some important characters are provided, and the distribution of the genus is shown to extend much further north than was known previously.

METHODS

Male right palps were removed, examined and drawn with a Wild M5 stereomicroscope. Epigyna were removed and cleared in methylsalicylate and temporarily mounted in a mixture of that medium and cedukol. They were observed and drawn with a Leitz Dialux 22 compound microscope. Scanning micrographs were made with a JEOL LV 5400 scanning microscope. All measurements are in millimeters.

Abbreviations.—a = diameter of PME, b = diameter of PLE, c = diameter of AME, d = diameter of ALE, e = distance between PME, f = distance between PME and PLE, g = distance between AME, h = distance between AME and ALE. ALE = anterior lateral eyes, AME = anterior median eyes, AW = anterior width (of the MOQ), L = length of the median ocular quadrangle, MOQ = median ocular quadrangle, PLE = posterior lateral eyes, PME = posterior median eyes, PW = posterior width (of the MOQ), PS = posterior spinnerets.

Institutions.—MHNG = Musée d’Histoire Naturelle, Genève (B. Hauser, P. Schwendinger); MNHN = Muséum National d’Histoire Naturelle, Paris (J. Heurtault & C. Rollard); MRAC = Musée Royal de l’Afrique Centrale, Tervuren (R. Jocqué); NMSA = Natal Museum, Pietermaritzburg (P. Croeser, A. Ruiters); NMZ = National Museum Zimbabwe, Bulawayo (M. Fitzpatrick); SMNW = State Museum, Windhoek, Namibia (E. Griffin).

TAXONOMY

Palfuria Simon 1910

Palfuria Simon 1910: 188 (description new genus).
Jocqué 1987: 143; 1991: 141.
Dippenaar Schoeman & Jocqué 1997: 327.

Hermippella Lessert 1936: 226 (description new genus); 1938: 432 (formerly included in the *Palfuridae*).

Note: Jocqué (1991) provisionally synonymized *Palfuria* and *Hermippella*; this synonymy can now be considered as definitive. It is indeed found that in juveniles, and even in some females, that the cephalic lobe is only raised and not slanting back as in *Palfuria retusa*.

Type species.—*Palfuria retusa* Simon 1910.

Diagnosis.—Easily recognized by the strongly elevated cephalic part of the carapace, slanting back in adults (except *P. spirembolus* female); the abdomen has dorsolateral circumferential folds. The genus is part of a large unresolved clade (Jocqué 1991) of genera with a femoral organ but the characters listed above unequivocally distinguish *Palfuria* from them. *Heradida* Simon 1893 is the only genus in that clade with abdominal circumferential folds and must be considered the sister-group of *Palfuria*.

Description.—(slightly modified after Jocqué 1991: 141–142.) Small spiders (1.41–3.4) with slightly to strongly granulated tegument. Carapace with strongly raised cephalic lobe, slanting back over the thoracic area in adults; widest between coxae III and IV; narrowed in front to about 0.75× maximum width in females, to about 0.65× maximum width in males. *Color:* Carapace and chelicerae pale to dark brown. Sternum pale yellow to dark brown, often with a darker margin. Legs dark brown to a pale yellow, sometimes with dark stripes; coxae and trochanters pale yellow, femora slightly darker, other leg segments paler. Abdomen pale to dark sepia on dorsum, pale on sides and venter. *Eyes:* In two strongly procurved rows (anterior one as seen in front, posterior one as seen from above). AME by far the largest up to 4× diameter of other eyes), dark (except *P. spirembolus*), circular. Other eyes pale, circular, though PME sometimes slightly ovoid. AME about half their diameter apart, about one diameter from

PLE; these almost contiguous with ALE and AME. MOQ subquadrangular. *Clypeus:* Convex, high 3.5–10× as high as diameter of ALE. Chilum absent. *Chelicerae:* Short, fused; without lateral condyle; without teeth, but with cheliceral lamina (Fig. 4). Intercheliceral triangle most often small. Endites roughly rectangular, strongly converging; with anteromesal scopula. Labium triangular. Sternum as wide as long in females, longer than wide, slightly rebordered in males. *Legs:* Formula 4123. More slender in males than in females. Two claws on short onychium; with 2–4 teeth, third claw tiny; no claw tufts but spiniform scopulae present. One dorsal spine in proximal half of femora. Leg segments generally covered with flattened incised hairs (Figs. 1, 2), but femora with 2–4 long rigid hairs, (for example: in *P. gladiator*, *P. hirsuta*). Femoral organ with 1 or 2 barbed hairs (Fig. 1). Patellae with proximal ring-shaped crack (see Jocqué & Dippenaar-Schoeman 1992, fig. 5). *Abdomen:* Rounded, hardly longer than wide; slightly sclerotized on dorsum in females, more strongly so in males; anterior part of abdomen strongly sclerotized, forming tube around the petiolus; with a number of parallel shallow, circumferential folds. Two spinnerets in males, 4 spinnerets in females, PS minute. Colulus represented by broad field with short setae; a number of modified hairs in front of tracheal spiracle (Fig. 3); spiracle wide with anterior rim sclerotized. *Male palp:* (Figs. 5–15): Tibia with one or two slender lateral apophyses. Cymbium with distal filed of short hairs and one or two dorsolateral modified hairs. Embolus originating on posterior part of tegulum (except *P. spirembolus*), curved, relatively short. Tegular apophysis fairly short, sometimes bifurcate. *Female palp:* With finely pectinated claw. *Epigynum:* (Figs. 16–29) Very simple to relatively complex, poorly sclerotized except in *P. helichrysorum*.

Distribution.—Africa south of 4°S: found in Tanzania, Namibia, Malawi, Zambia, Mozambique, South Africa.

KEY TO THE SPECIES

- Note: Palfuria retusa* Simon is not included since it is known only from the juvenile.
1. Males 2
Females 6
 2. Embolus long, looped around the tegulum (Figs. 14, 15). *Palfuria spirembolus*
Embolus very short (Figs. 5–10, 12, 13) 3
 3. Palpal tibia with two apophyses, one dorsal,
one retrolateral (Figs. 6, 10–11) 4
Palpal tibia with only one apophysis (Figs. 8, 13) 5
 4. Dorsal apophysis almost straight (Fig. 6). *Palfuria capitlari*
Dorsal apophysis harpoon shaped; slightly curved, pointed, with a branch pointing backwards,
ending in a few fine, hair like ramifications (Figs. 10, 11). *Palfuria harpago*
 5. Tibial apophysis straight (Fig. 8) *Palfuria gladiator*
Tibial apophysis curved (Fig. 13) *Palfuria panner*
 6. Epigynum with well delimited plate (Figs. 16, 17, 19, 20). 7
Epigynum without a plate, but with sclerotized posterior margin (Figs. 18, 21, 22) 10
 7. Epigynal plate of different shape, with posterior margin sinuous and indented in the middle (Fig. 19). *Palfuria helichrysum*
Epigynal plate ellipsoid (Figs. 16, 17, 20) 8
 8. Entrance openings situated near posterior margin of epigynum. Spermathecae under plate, lateral margins of epigynum plate angular (Fig. 17). *Palfuria gibbosa*
Entrance openings—if visible—nearer to anterior margin of the epigynum; spermathecae at variable distance from epigynal plate, but never under it. Lateral margins of epigynum plate evenly rounded (Figs. 16, 20). 9
 9. Internal structure of epigynum relatively complex, sperm ducts long and wound (Fig. 27). *Palfuria hirsuta*
Internal structure of epigynum simple, sperm ducts short and slightly curved (Fig. 23) *Palfuria capitlari*
 10. Epigynum with only a simple, small, sclerotized posterior margin (Fig. 18). *Palfuria gladiator*
Epigynum with differently shaped sclerotized parts 11
 11. Sclerotized margin of the epigynum straight, situated posteriorly, spermathecae rounded; atria large (Figs. 21, 28). *Palfuria panner*
Posterior margin of epigynum accolade shaped, spermathecae oval; atria small, glandular organ present (Figs. 22, 29) *Palfuria spirembolus*

Palfuria capitlari new species

Figs. 1–6, 16, 23, 30, 31

Holotype.—Male, Tanzania, Mkomazi Game Res., Ibaya camp, Nov. 1994, Russell-Smith (MRAC 202.528).

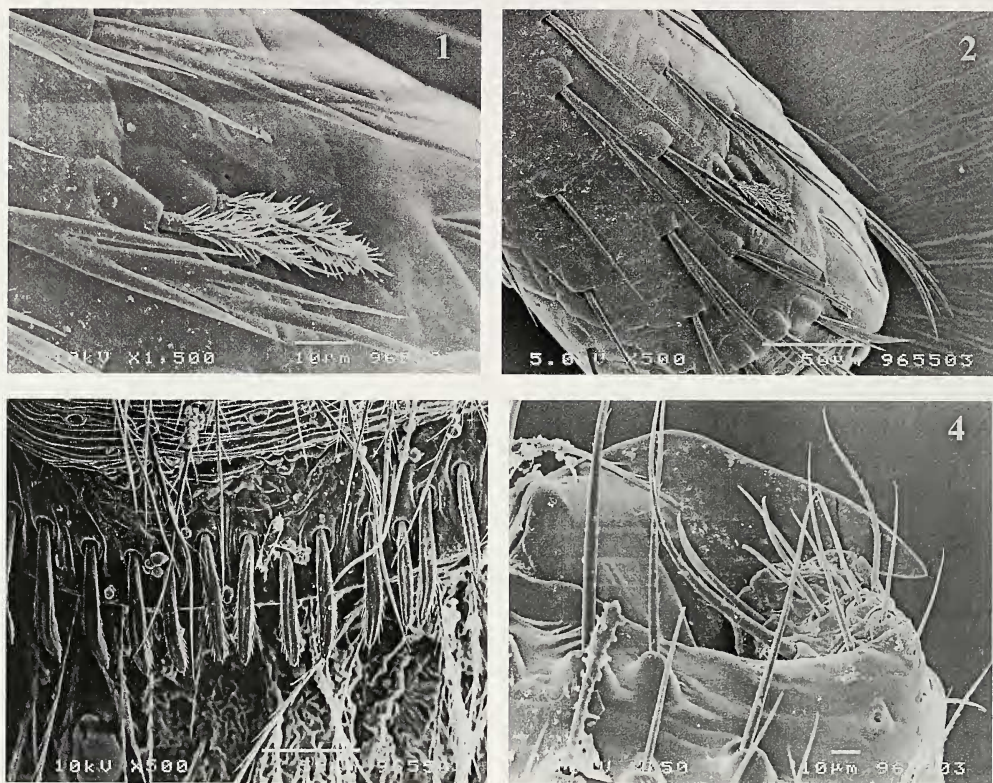
Paratypes.—3♀ 14♂ together with holotype.

Diagnosis.—Males of *Palfuria capitlari* are easily identified by the long, slender dorsolateral tibial apophysis of the palp and the hook-shaped median apophysis (Figs. 5–6). Females are recognized by the epigynal plate which is much wider than long (length/width 0.3) (Fig. 16). The male shows superficial resemblance with *P. harpago* with which it shares the presence of two tibial apophyses; in the latter species the dorsolateral apophysis is harpoon-shaped; the female is similar to *P. hirsuta* but lacks the long entrance ducts of

that species. The sister-species of *P. capitlari* is *P. harpago*.

Etymology.—The species name is composed of two Latin nouns: *caput* (head) and *lari* (gen. of *Larus*: gull), referring to the shape of the median apophysis as seen from the side.

Male.—Total length 2.24 (2.24–2.35); carapace 1.12 long (1.12–1.32), 0.82 wide (0.77–0.91). **Color:** Carapace medium to dark brown, with some faint, darker striae in thoracic area. Cephalic lobe dark brown, with some paler spots. Eye field dark brown. Chelicerae medium brown, fangs yellow, cheliceral lamina white, sternum medium brown, sometimes with dark margin; legs paler: coxae pale yellow, femora dark brown, other leg segments pale yellow. Abdomen: dorsum dark sepia with yellow folds, contrasting with pale yellow venter. Branchial operculum dark yellow.



Figures 1–4.—*Palfuria capulhari*, male from Mkomazi Game Reserve. 1, Femoral organ, leg I; 2, Position of femoral organ on right femur I; 3, Modified hairs in front of spinnerets; 4, Cheliceral lamina.

low. *Carapace*: (Figs. 30, 31): Tegument slightly granulated. *Chelicerae*: setae of cheliceral lamina curved, subequal. *Abdomen*: Circumferential folds not conspicuous, modified hairs in front of spinnerets stout. *Eyes*: a: 0.06; b: 0.06; c: 0.13; d: 0.06; e: 0.13; f: 0.14; g: 0.05; h: 0.04; MOQ: AW = 1.35 PW; AW = 1.25 L. Clypeus: 0.39 or $6.5\times$ diameter of ALE. *Legs*: All segments covered by flattened incised hairs. Two dorsal spines and three long ventral rigid hairs on all femora. *Male palp*: (Figs. 5, 6). Tibia with two apophyses; one dorsal, one retrolateral; dorsal apophysis long, thin, almost straight; retrolateral apophysis medium sized, wider; median apophysis pointed, hook shaped; embolus short, blunt.

Female.—Total length 2.44 (2.31–2.44); carapace 1.42 long (1.22–1.42), 1.02 wide (0.91–1.02). *Color*: Carapace medium to dark brown, with some darker striae in thoracic area. Cephalic lobe dark brown, with some paler spots. Chelicerae medium brown, fangs yellow, cheliceral lamina white, sternum pale brown, with dark margin, legs paler: coxae

pale yellow, femora dark brown, paler on the ventral side, other leg segments pale yellow. Abdomen: dorsum dark sepia with yellow folds, contrasting with pale yellow venter. Branchial operculum dark yellow. *Carapace*: Hair cover slightly denser than in males. *Abdomen*: Circumferential folds poorly marked, modified hairs in front of spinnerets stout. *Epigynum*: (Figs. 16, 23). With narrow plate, with dark posterior margin; internal structure of epigynum simple: sperm ducts short, almost straight, spermathecae rounded.

Distribution.—Only known from type locality.

Palfuria gibbosa (Lessert)

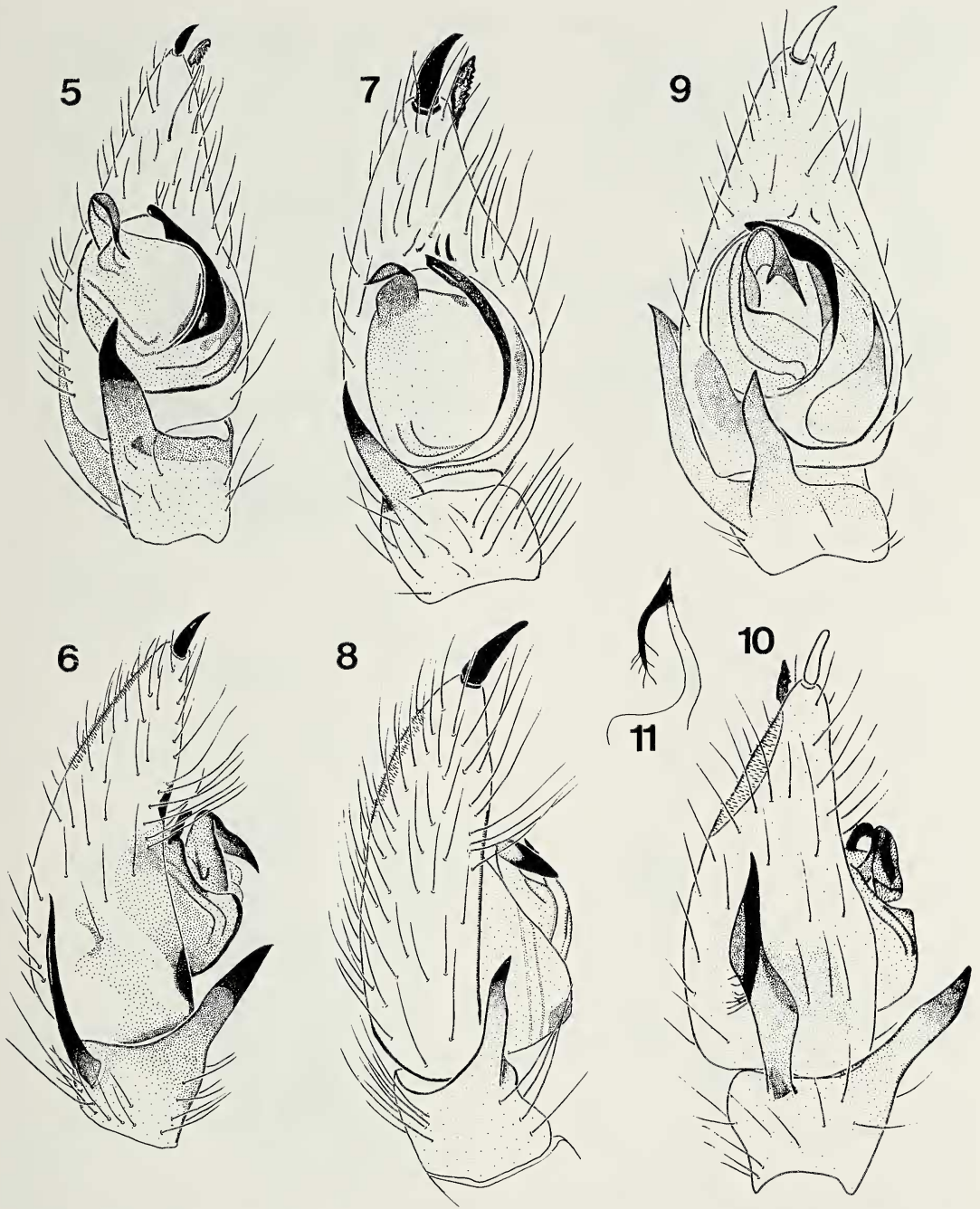
Figs. 17, 24

Hermippella gibbosa Lessert 1936: 226 (description female); 1938: 432.

Palfuria gibbosa: Jocqué 1991: 142.

Holotype.—Female, Mozambique, Nova Choupanga (? near Chupanga 18°05'S, 35°35'E) (MHNG) (examined).

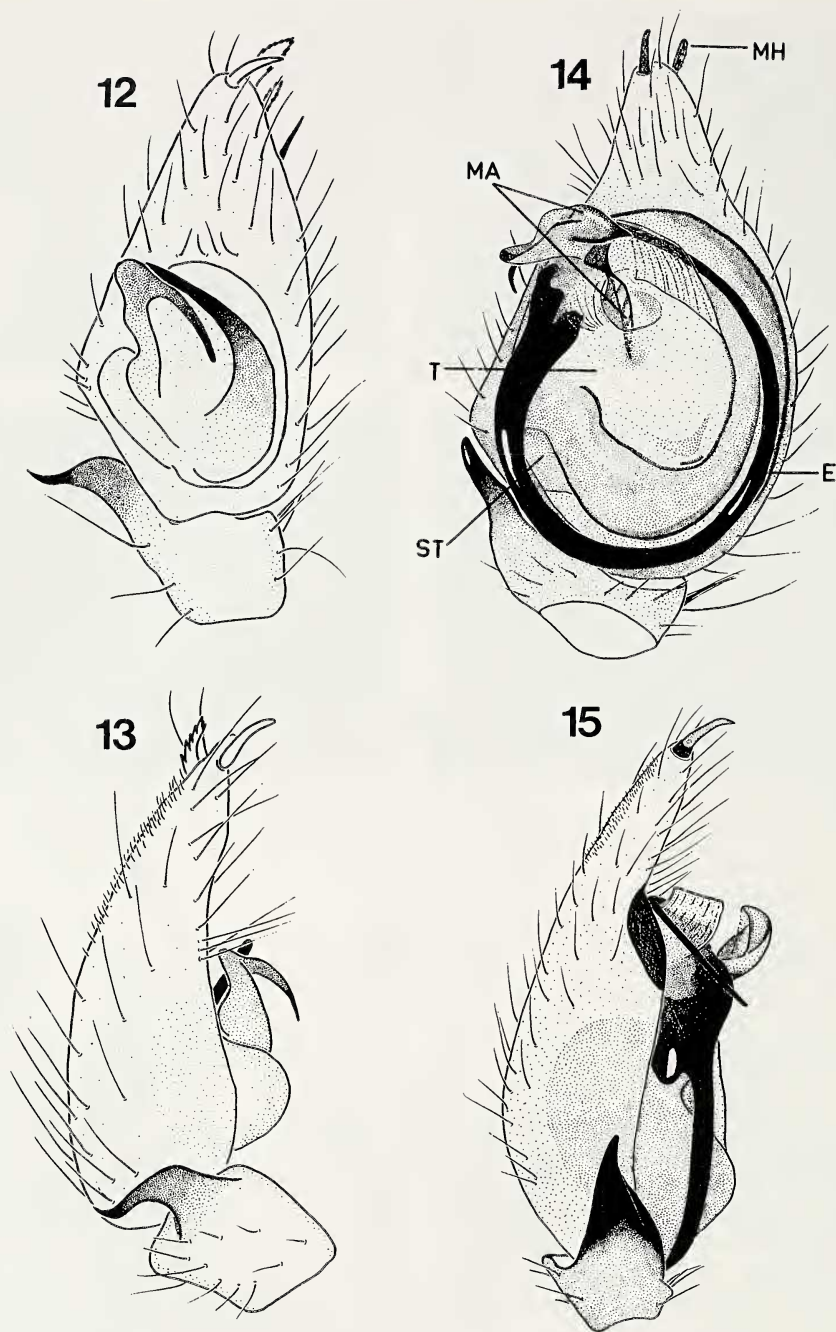
Diagnosis.—The females of *Palfuria gib-*



Figures 5–11.—Male palps. 5, 6. *Palfuria caputlari* from Mkomazi Game Reserve. 5, Ventral view; 6, Retrolateral view. 7, 8. *P. gladiator*, holotype. 7, Ventral view; 8, Retrolateral view. 9–11. *P. harpago*, holotype; 9, Ventral view; 10, Retrolateral view; 11, Detail of dorsolateral apophysis, dorsal view.

bosa can be recognized by the shape of the epigynal plate, the entrance openings near the posterior margin of the plate and the presence of glands. The epigynum vaguely resembles that of *P. helichrysorum* but lacks the poste-

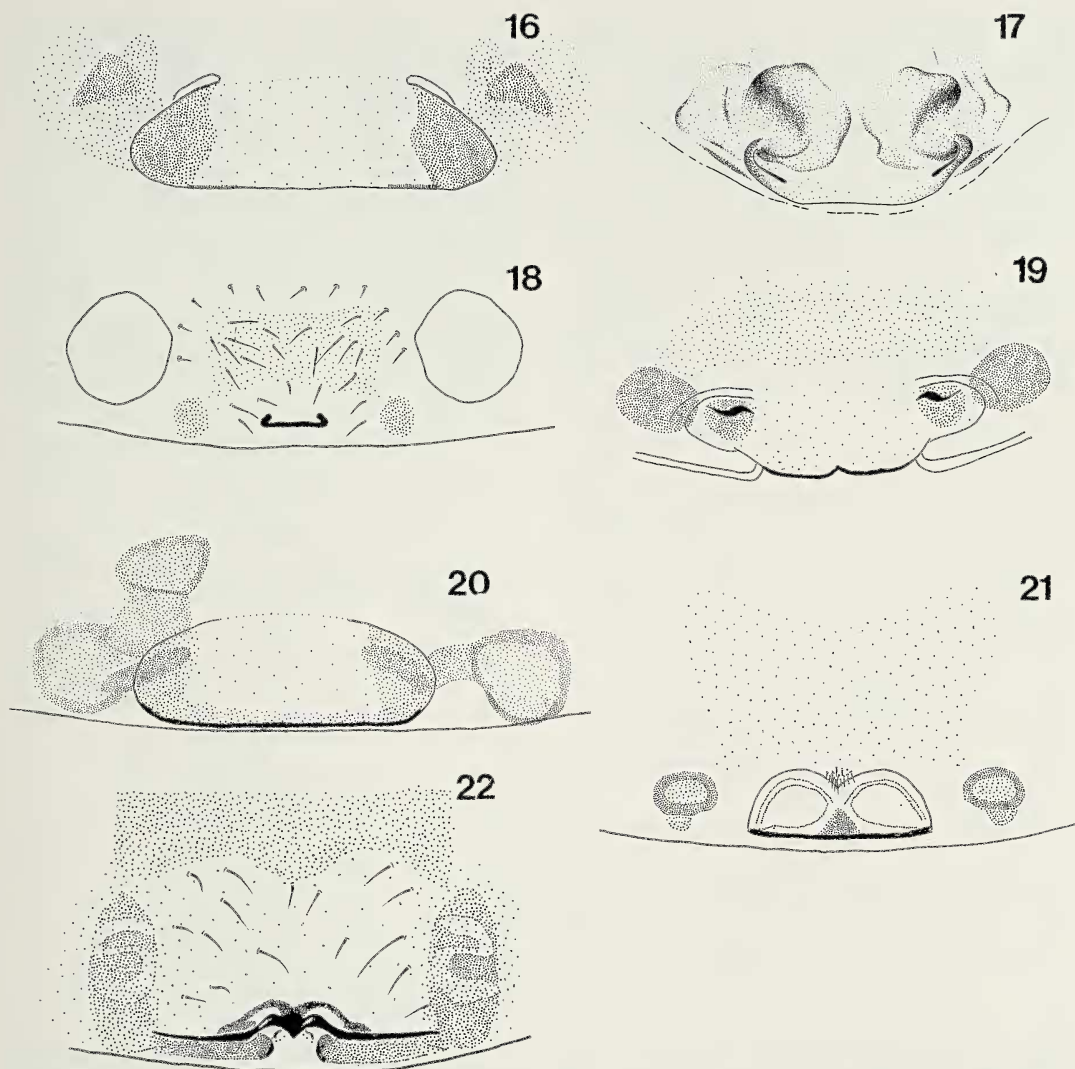
rior median indentation; the epigynal plates of *P. caputlari* and *P. hirsuta* both have rounded lateral margins and a sclerotized posterior rim. The closest relatives of *P. gibbosa* are *P. spirembolus* and *P. hirsuta*.



Figures 12–15.—Male palps. 12, 13. *Palfuria panner*, SMNW42872; 12, Ventral view; 13, Retrolateral view; 14, 15. *P. spirembolus*, holotype; 14, Ventral view; 15, Retrolateral view. (E = embolus; MA = median apophysis; MH = modified hair; ST = subtegulum; T = tegulum).

Female.—Total length 2.30, carapace 1.10 long, 0.64 wide. *Color:* Carapace medium brown in cephalic area, pale brown in thoracic area; chelicerae medium brown. Sternum yellow. Legs pale yellow. Abdomen greyish-yel-

low on sides and venter. *Carapace:* (see Jocqué, 1991 figs. 354–356). With raised cephalic lobe slanting back over thoracic area. *Eyes:* a: 0.06; b: 0.06; c: 0.1; d: 0.08; e: 0.12; f: 0.07; g: 0.06; h: 0.03. MOQ: AW = 1.04



Figures 16–22.—Epigyna, ventral view. 16, *Palfuria caputlari* from Mkomazi Game Reserve; 17, *P. gibbosa*, holotype; 18, *P. gladiator*, paratype; 19, *P. helichrysorum*, holotype; 20, *P. hirsuta*, holotype; 21, *P. panner* from Windhoek; 22, *P. spirembolus* from Kokerboom forest.

PW; AW = 1.00 L. *Legs*: only leg II complete. *Epigynum*: (Figs. 7, 24). Entrance openings situated near posterior margin, spermathecae under epigynal plate, provided with angular lateral margin.

Male.—Unknown.

Distribution.—Only known from type locality.

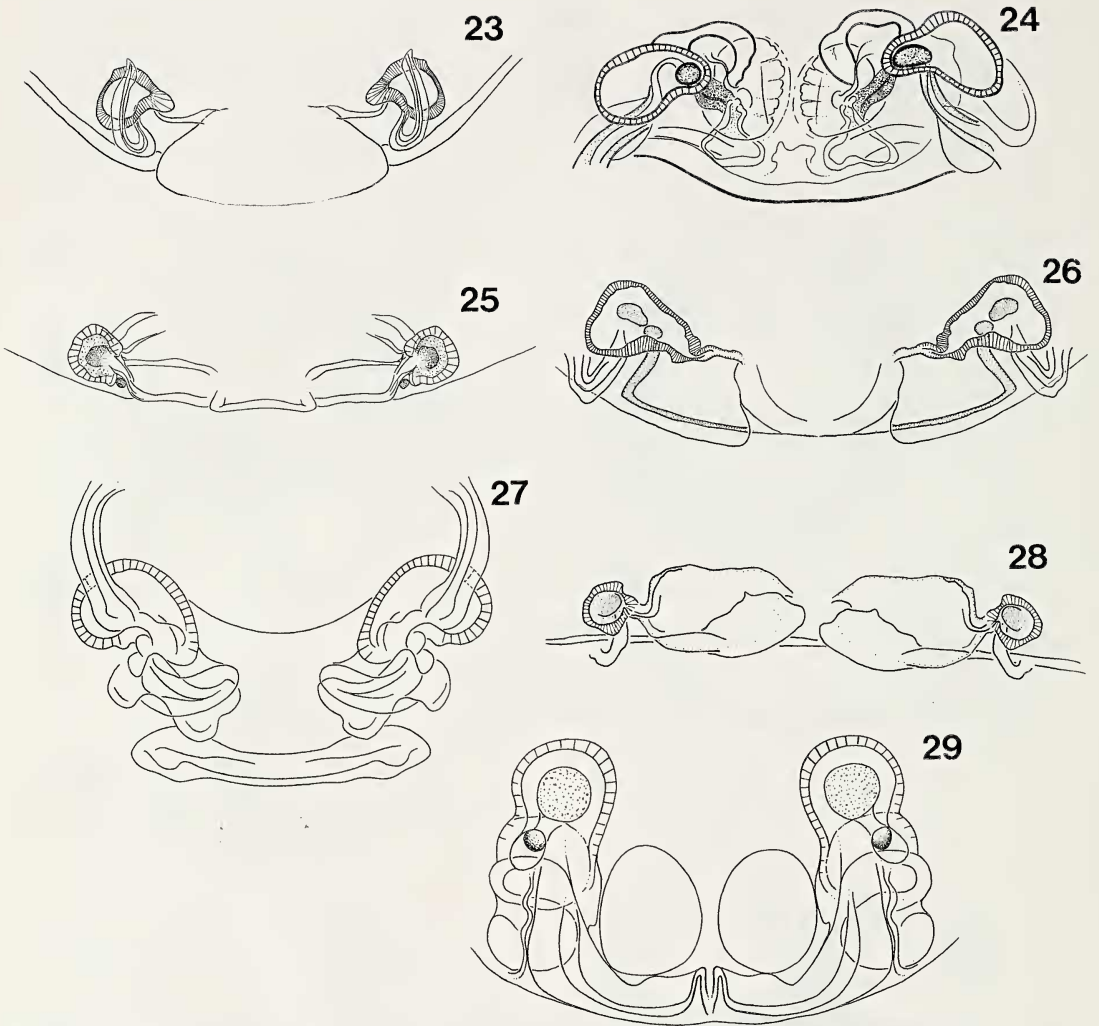
Palfuria gladiator new species

Figs. 7, 8, 18, 25

Holotype.—Male, Namibia, Karossfontein 19°21'S, 14°31'E, 7 Oct.–14 Nov. 1986, pitfall traps, E. Griffin (SMNW 39751).

Paratypes.—Namibia: 2♂ together with holotype; ♂ from Windhoek, wasteland near houses, 14–31 Oct. 1987 pitfall traps, R. Jocqué (MRAC 168.421); 6♂ 1♀ from Damaraland, Hobatere Campsite, 19°8'S, 14°7'E, 23–30 April 1996, pitfall traps, E. Griffin (SMNW 43540; 1♂ in MRAC); ♂ and ♀ from Hobatere Campsite, 3.2 km from gate, 19°9'S, 14°7'E, 7–17 May 1991, pitfall traps (SMNW 42632); ♀ from Wolfsnes, 19°03'S, 15°52'E, 24 March–10 May 1988, pitfall traps, E. Griffin (SMNW 40890).

Diagnosis.—Representatives of this species can be recognized by the strongly granulated



Figures 23–29.—Epigyna, cleared, dorsal view. 23, *Palfuria caputlari* from Mkomazi Game Reserve; 24, *P. gibbosa*, holotype; 25, *P. gladiator*, paratype; 26, *P. helichrysum*, holotype; 27, *P. hirsuta*, holotype; 28, *P. panner* from Windhoek; 29, *P. spirembolus* from Kokerboom forest.

tegument of the carapace and by the two (one dorsal, one ventral) long, rigid hairs on tibia II-III. Males of *Palfuria gladiator* are characterized by the big cymbial claw and the almost straight palpal tibial apophysis. The females can easily be identified by the epigynum, appearing as a short, sclerotized, transverse line. Males and females are superficially similar to those of *P. panner*, the closest relative, but in that species the male palpal tibial apophysis is turned upwards and in the female there is a slight depression in front of the sclerotized epigynal rim.

Etymology.—The species name is a noun in apposition and refers the shape of the male

carapace and the big tarsal claw on the male palp.

Male.—Total length 2.04 (1.41–2.04); carapace 1.06 (0.75–1.06) long, 0.71 (0.56–0.71) wide. *Color:* Carapace dark brown; cephalic area much darker, thoracic area paler, with some darker striae, cephalic lobe of carapace dark brown, lateral part of carapace paler, contrasting with dark top. Chelicerae brown, fangs yellow, cheliceral lamina poorly developed, sternum pale yellow with dark margin; legs paler: coxae pale yellow, femora I-II dark brown, femora III-IV dark brown on dorsal side, paler on ventral side, tibiae dark yellow, other leg segments pale yellow. Abdomen

dorsum dark sepia with paler folds, venter pale yellow, with contrasting boundary between them on sides. Branchial operculum pale brown. *Carapace*: Tegument strongly granulated. *Chelicerae*: Setae on cheliceral lamina small, poorly developed in males. Base of fangs strongly granulated, with long setae. *Sternum*: with many, fine hairs. *Abdomen*: Dorsum with some strong hairs. Modified hairs in front of spinnerets strong. *Eyes*: a: 0.05; b: 0.05; c: 0.11; d: 0.07; e: 0.12; f: 0.10; g: 0.04; h: 0.01; MOQ: AW = 1.18 PW; AW = 1.04 L. *Clypeus*: 0.3 or 4.2× diameter of ALE. *Legs*: All segments covered with flattened incised hairs. One dorsal spine, three ventral rigid hairs on all femora, one dorsal, one ventral rigid hair on tibia II-III. *Male palp*: (Figs. 7, 8). Tibia with one almost straight; medium sized prolateral apophysis; median apophysis pointed, hook-shaped; embolus long, blunt.

Female.—Total length 2.47 (2.04–2.27); carapace 1.03 long (0.9–1.03), 0.92 wide (0.75–0.92). *Color*: Carapace dark brown, with some darker striae in thoracic area, which paler. Cephalic lobe dark brown. *Chelicerae* brown, fangs yellow, cheliceral lamina white; sternum pale brown, with dark margin; legs paler: coxae pale yellow, femora dark brown, paler on ventral side, other leg segments pale yellow. *Abdomen*: dorsum dark sepia with yellow folds, contrasting with pale yellow venter. Branchial operculum dark yellow. *Carapace*: Hair cover slightly denser than in males. *Abdomen*: Circumferential folds not conspicuous; some stout modified hairs in front of the spinnerets. *Epigynum*: (Figs. 18, 25). Simple; with short, transverse sclerotized line. Internal structure of epigynum similar to that of *Palfuria panner*, but fertilization ducts turned upward.

Distribution. Known only from Namibia.

Palfuria harpago new species

Figs. 9–11

Holotype.—Male, Namibia, Ovamboland, 10 km SE Etunda, 17°26'S, 14°33'E, 20 July–9 August 1989, pitfall traps, E. Marais (SMNW 41413).

Paratype.—1♂ from Namibia, Ovambo, Mahanene Agric. Res. Sta., 17°26'S, 14°47'E, 5 October–5 December 1993, pitfall traps, B. Wohlleber (SMNW 43396).

Diagnosis.—Males of *Palfuria harpago* are

easily identified by the shape of the dorsolateral tibial apophysis: almost straight, pointed and with a branch pointing backwards, ending in a few, fine hair-like ramifications. *Palfuria caputlari* is the only other *Palfuria* with two palpal tibial apophyses; in *P. caputlari*, however, the dorsal one is long, straight and spine-shaped. The sister-species of *P. harpago* is *P. caputlari*.

Etymology.—The species name is a noun in apposition (*harpago*, Latin for harpoon) referring to the shape of the dorsal tibial apophysis as seen from the dorsolateral side (Fig. 11).

Male.—Total length 1.81 (1.81–1.98); carapace 1.13 long (1.03–1.22), 0.92 (0.66–0.92) wide. *Color*: Carapace medium to dark brown, with some faint, darker striae in thoracic area. Cephalic lobe pale brown with dark margin. Eye field dark brown. *Chelicerae* medium brown, fangs dark brown, cheliceral lamina white; sternum pale brown, without darker margin; legs pale brown or yellow. *Abdomen*: dorsum shiny, dark sepia with pale circumferential folds, venter dark yellow, contrasting with dark sides. Branchial operculum dark yellow. *Carapace*: Tegument slightly granulated on cephalic lobe. *Chelicerae*: Setae of cheliceral lamina curved, and subequal. *Abdomen*: Modified hairs in front of spinnerets fine and long, but few. Ventral side of abdomen with many hairs. *Eyes*: a: 0.05; b: 0.05; c: 0.11; d: 0.09; e: 0.19; f: 0.05; g: 0.04; h: 0.02; MOQ: AW = 1.18 PW, AW = 1.36 L. *Clypeus*: 0.32 or 3.5× diameter of ALE. *Legs*: All segments covered with flattened incised hairs. Femora with one dorsal spine and cover of ordinary hairs. *Male palp*: (Figs. 9, 10). Tibia with two apophyses; one ventral, one dorsolateral. Ventral apophysis short and wide, slightly curved, dorsolateral apophysis long, pointed, harpoon-shaped, with back-pointing branch ending in few thin ramifications. Median apophysis strongly curved, bifid, ending in two pointed tips; embolus short, wide, subtegulum present, hidden under cymbium.

Female.—Unknown.

Distribution.—Only known from Ovamboland, Namibia.

Palfuria helichrysum new species

Figs. 19, 26

Holotype.—Female, Malawi, Mt. Mulanje, Lichenya plateau (2000 m), near CCAP hut,

15°59'S, 35°32'E, 9 November 1981, under *Helichrysum*, R. Jocqué (MRAC 156.781).

Diagnosis.—*Palfuria helichrysorum* females are recognized by the sclerotized epigynum and the shape of the central plate with two frontal lobes covering the entrance openings, and indented posterior margin, and by the internal structure of the epigynum with short, thick-walled sperm ducts. The other species with an epigynal plate, *P. caputlari*, *P. gibbosa* and *P. hirsuta* lack the posterior indentation. *P. helichrysorum* is the sister-taxon of a group of three species comprising *P. hirsuta*, *P. spirembolus* and *P. gibbosa*.

Etymology.—The specific name is derived from *Helichrysum*, a rosette bearing Asteraceae, ideal retreat for night active spiders.

Female.—Total length 3.06; carapace 1.32 long 0.98 wide. *Color*: Carapace dark brown, with some darker striae in thoracic area. Cephalic lobe dark. Chelicerae brown, fangs yellow, cheliceral lamina white, sternum pale brown, with wide, dark margin; legs paler: coxae yellow, femora dark brown, femora I-II paler on ventral side, other leg segments pale yellow, contrasting with dark femora. Abdomen: dorsum dark sepia with yellow, circumferential folds; venter pale yellow, contrasting with dark sides. Branchial operculum brown. *Carapace*: Finely granulated. *Chelicerae*: Setae of cheliceral lamina straight, unequal in length. *Abdomen*: Dorsum with few fine hairs. Modified hairs in front of spinnerets fine. *Eyes*: a: 0.07; b: 0.07; c: 0.12; d: 0.07; e: 0.16; f: 0.08; g: 0.08; h: 0.08; MOQ: AW = 1.06 PW; AW = 1.15 L. *Clypeus*: 0.34–4.8× diameter of ALE. *Legs*: Covered with flattened incised hairs. Femora with one dorsal spine and three long ventral rigid hairs. *Epigynum*: (Figs. 19, 26). Well-sclerotized; central plate with two anterior lobes covering entrance openings, posterior margin indented. Internal structure of epigynum quite simple with short, thick walled sperm ducts.

Male.—Unknown.

Distribution.—Only known from type locality.

Palfuria hirsuta new species

Figs. 20, 27

Holotype.—Female, Zambia, Wildlives Game Farm, 16°52'S, 26°37'E, B.F.A. Study Plot, 8–14 Dec. 1994, F. Nyathi (NMZ/A11862).

Diagnosis.—The female of *Palfuria hirsuta* is recognized by the large epigynal plate with clearly sclerotized posterior rim, and the internal structure of the epigynum with long and winding sperm ducts, but lacking a glandular organ. In the other species with an epigynal plate the shape is clearly different (*P. gibbosa*; *P. helichrysorum*) or the entrance ducts are much shorter (*P. caputlari*). *Palfuria hirsuta* is the sister species of *P. spirembolus* and *P. gibbosa*.

Etymology.—The species name refers to the hairy appearance.

Female.—Total length 2.32; carapace 1.16 long, 0.85 wide. *Color*: Carapace brown; cephalic area dark, thoracic area paler, with some faint darker striae, cephalic lobe very dark. Chelicerae dark brown, fangs yellow, cheliceral lamina white, sternum yellow, with dark margin, anterior part of sternum darker; legs darker: coxae yellow, femora brown with darker sides, other leg segments slightly paler. Abdomen: sepia on dorsum, with yellow folds, pale yellow on venter, but dorsal dark area narrow. Pale spots on sepia background rounded or irregular. *Carapace*: Slightly granulated, with many fine hairs. *Chelicerae*: lamina with two straight setae of different length. *Sternum*: Sternum with fine hairs on anterior—darker—part. *Abdomen*: Dorsum with many fine hairs. Modified hairs in front of spinnerets strong. *Eyes*: a: 0.06; b: 0.07; c: 0.1; d: 0.06; e: 0.06; f: 0.08; g: 0.07; h: 0.04; MOQ: AW = 1.17 PW; AW = 0.96 L. *Clypeus*: 0.35–5.8× diameter of ALE. *Legs*: Segments covered with flattened incised hairs, but femora, patella, tibia with many rigid hairs. *Leg spination*: One dorsal spine on all femora, long rigid hairs on femora, patella, tibia, but none on tarsi, metatarsi. *Epigynum*: (Figs. 20, 27). With simple ellipsoid plate. Internal structure of epigynum complex: sperm ducts long and intricately wound.

Male.—Unknown.

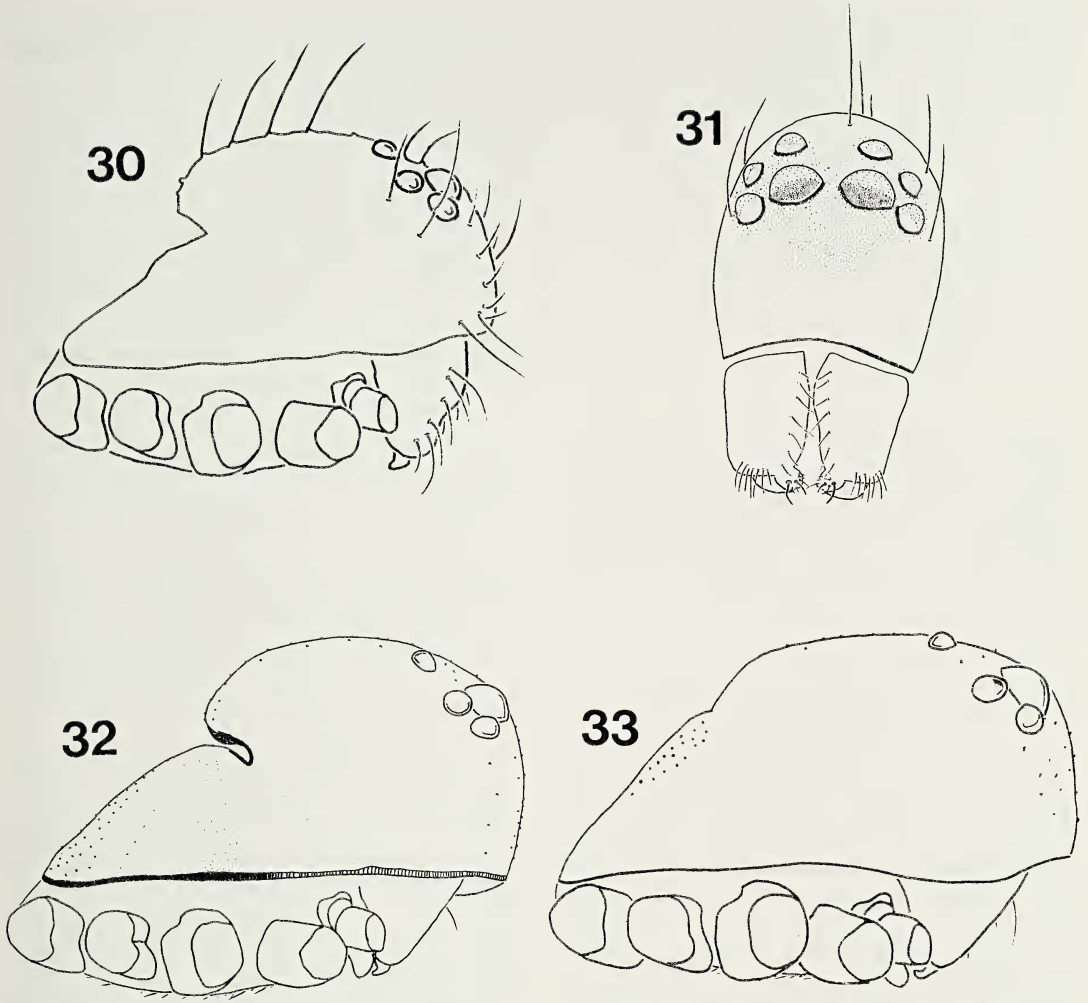
Distribution.—Only known from type locality.

Palfuria panner Jocqué

Figs. 12, 13, 21, 28

Palfuria panner Jocqué 1991: 142 (description male, figs. 359–363).

Holotype.—Male, Namibia, Panner Gorge, 22°19'S 15°01'E, 11 March–9 April 1985, J. Irish and H. Rust (SMN 38730).



Figures 30–33.—Carapace. 30, 31. *Palfuria caputlari*, male from Mkomazi Game Reserve. 30, Carapace, lateral view; 31, Frontal view. 32, 33. *Palfuria spirembolus* from Kokerboom forest. 32, Male carapace, lateral view; 33, Female carapace, lateral view.

Other material examined.—**NAMIBIA:** 1 ♂ from Otjiwarongo district, Waterberg Plateau Park, 20°24'S, 17°23'E, 18 May–24 April 1991, pitfall traps, M. Push (SMNW 42465); 1 ♂ from sand dunes east of Jakkalsputz, SE 2214 Ab, 17–23 April, pitfall traps, 1994, E. Griffin (SMNW 43229); 1 ♂ from Windhoek district, Richthofen 126, 22°15'S, 17°30'E, 1–31 Oct. 1979, pitfall traps, M.-L. Pentith (SMNW 42872); 1 ♀ from Windhoek, in trunks and leaves of dead Aloe, 15 Oct. 1987, R. Jocqué (MRAC 168.482); 1 ♀ from Fransfontein 2015 AA, 22. Feb. 1969, B. Lamoral & R. Day (NMSA); 1 subadult ♂ from Lüderitz district, 29°59'S, 16°14'E, 22 Nov. 1995, under stones, E. Griffin (SMNW 43479).

Diagnosis.—Males of *Palfuria panner* can be recognized by the upward curved palpal

tibial apophysis (Fig. 13) and simple fairly long median apophysis. The females can be recognized by the shape of the shallow epigynal depression in front of a sclerotized ridge and the large atria in the epigynum (Fig. 28). The only other species with a simple retrolateral tibial apophysis is *P. gladiator*, but in that species the tibial apophysis is almost straight. The female of *P. gladiator* has a sclerotized line but lacks the depression in front of it. *Palfuria panner* is closely related to *P. gladiator*.

Note: In the holotype, the tip of the tibial apophysis is broken off; the drawing in Jocqué (1991, fig. 361) does not give the normal shape of this apophysis which is here corrected.



Figure 34.—Distribution map of *Palfuria* species. ● = *P. capulhari*; ■ = *P. gibbosa*; △ = *P. gladiator*; ○ = *P. harpago*; ◆ = *P. helichrysum*; ▲ = *P. hirsuta*; □ = *P. panner*; ◇ = *P. retusa*; ★ = *P. spirembolus*.

Male.—Total length 1.82 (1.69–2.0); carapace 0.90 (0.73–0.98) long, 0.64 (0.58–0.64) wide. *Color*: Carapace dark brown in cephalic area, medium brown with darker striae in thoracic area cephalic lobe pale brown, with some pale spots. Eye field darker. Chelicerae medium brown; sternum shiny dark brown; legs dark brown. Abdomen sepia on dorsum and sides, pale yellow on venter. Branchial operculum medium brown. *Carapace*: Slightly granulated. Cephalic lobe low. *Abdomen*: Circumferential folds well developed. Modified hairs in front of spinnerets stout. *Eyes*: a: 0.05; b: 0.06; c: 0.09; d: 0.05; e: 0.10; f: 0.04; g: 0.05; h: 0.01; MOQ: AW = 1.09 PW; AW: 1.00 L. *Clypeus*: 0.26–5.2× diameter of ALE. *Legs*: Segments covered with flattened incised hairs. Femora with one dorsal spine and three ventral, rigid hairs; tibiae with one ventral rigid. *Male palp*: (Figs. 12, 13). Cymbium with two modified hairs and one spine. Tibial apophysis curved upward. Median apophysis pointing inward, hook shaped.

Female.—Total length 2.23; carapace 1.28 long, 0.92 wide. *Color*: Carapace brown; cephalic area darker, thoracic area pale, with some dark striae. Chelicerae brown, fangs yellow, cheliceral lamina white, sternum yellow with narrow dark margin; legs paler: coxae yellow; femora dark brown, patellae yellow, tibiae dark yellow, with few brown rings, other leg segments much paler. Abdomen: dor-

sum dark sepia with yellow stripes, venter paler, contrasting with darker sides. Branchial operculum pale brown. *Carapace*: Tegument slightly granulated. Cheliceral lamina with two hairs; one stout, short, one finer and longer. Sternum with fine hairs. *Abdomen*: Dorsum with few stout hairs. Modified hairs in front of spinnerets stout and strong. *Epigynum*: (Figs. 21, 28) With sclerotized margin. Incurved, anterior edge with many, fine hairs. Internal structure: openings funnel-shaped, sperm ducts short, spermathecae thick-walled. Fertilization ducts curved downwards.

Distribution.—Only known from Namibia.

Palfuria retusa Simon

Palfuria retusa Simon 1910: 188 (description juv. female); Jocqué 1991: 142 (figs. 352, 353).

Holotype.—Juvenile female, South Africa, Namaqualand, Steinkopf, Shultze (MNHN 1573) (not examined).

Diagnosis.—Recognized by the dark stripes on the femora. Since this species is only known from a juvenile it is not possible to discuss its affinities.

Subadult female.—Total length: 1.98; carapace 1.00 long, 0.72 wide. *Color*: Carapace pale brown with dark margin. Chelicerae pale brown, sternum pale yellow, legs pale yellow: femora with dark stripes. Abdomen dorsum pale sepia with pale stripes in back, remainder cream. *Carapace*: Finely granulated; cephalic area raised, but not slanting back. *Abdomen*: Almost globular; parallel circumferential folds poorly marked.

Adults.—Unknown.

Distribution.—Only known from type locality.

Palfuria spirembolus new species

Figs. 14, 15, 22, 29, 32, 33

Holotype.—♂, NAMIBIA: Keetmanshoop district, Khabus 146, on dolerite hill, east slope, 26°17'S, 18°14'E, 1 Oct.–8 Dec. 1988, pitfall traps, N.G. Olivier (SMNW 42286).

Paratypes.—NAMIBIA: 1♂ and a juvenile together with holotype; 1♂ from Keetmanshoop district, Dassiefontein 87, 27°13'S, 18°35'E, 7–27 Nov. 1992, pitfall traps, E. Marais (SMNW 42767); 1♀ from Kokerboom forest, 26°28'S 18°14'E, 16 Oct. 1984, under stones, E. Griffin (SMNW 43179); 1♀ from Mariental district, Berseba 170, 25°12'S, 18°03'E, 7–29 Nov. 1992, pitfall traps, E. Marais (SMNW 42880).

Table 1.—Character matrix for species of *Palfuria* and the outgroups *Heradida* and *Diores*.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<i>Diores</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Heradida</i>	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
<i>P. caputlari</i>	1	1	0	0	1	0	1	0	1	0	2	0	0	0	0
<i>P. gibbosa</i>	1	1	0	?	?	?	?	?	?	?	2	0	1	1	1
<i>P. gladiator</i>	1	1	0	0	0	0	1	0	1	1	0	0	0	0	0
<i>P. harpago</i>	1	1	0	0	1	0	1	0	2	1	?	?	?	?	?
<i>P. helichrysurum</i>	1	1	0	?	?	?	?	?	?	?	2	0	0	0	1
<i>P. hirsuta</i>	1	1	0	?	?	?	?	?	?	?	2	1	1	0	1
<i>P. panner</i>	1	1	0	1	0	0	0	0	0	0	0	0	1	0	0
<i>P. spirembolus</i>	1	1	0	2	0	1	2	1	3	1	1	1	1	1	2

Note: The males and the females are tentatively attributed to the same species, because both sexes were found in Keetmanshoop district.

Diagnosis.—Males of *Palfuria spirembolus* are easily identified by the long, slender embolus, the complex median apophysis and by the long carapace. Females are recognized by the accolade shape of the sclerotized rim of the epigynum, and by the internal structure of the epigynum: glandular organ present, sperm ducts long and wound, spermathecae oval. Certain of the characteristics of the secondary genital organs of this species are unique and exclude confusion with other species. *Palfuria spirembolus* appears to be closely related with *P. hirsuta* and *P. gibbosa*.

Etymology.—The species name is a contraction of *spira* (Latin for spiral) and *embolus*, referring to the long large embolus.

Male.—Total length 2.22 (2.15–2.45); carapace 1.22 long (1.03–1.47), 0.88 (0.83–0.91) wide. *Color:* Carapace medium to pale brown, with some darker, striae in thoracic area. Cephalic lobe pale brown. Eye field pale brown. Anterior part of carapace dark brown. Chelicerae medium brown, fangs dark yellow, cheliceral lamina white, sternum pale brown, with narrow darker margin; legs paler: femora pale brown, other leg segments yellow. Abdomen: dorsum shiny, dark sepia with pale circumferential folds, venter medium brown, contrast-

ing with dark sides. Branchial operculum dark brown. *Carapace:* (Fig. 32). Tegument slightly granulated: cephalic part of carapace finely granulated, cephalic lobe with stronger granulations. *Chelicerae:* Setae of cheliceral lamina curved, subequal. *Abdomen:* With scutum, modified hairs in front of spinnerets fine and long. *Eyes:* All eyes pale. a: 0.03; b: 0.07; c: 0.13; d: 0.05; e: 0.15; f: 0.11; g: 0.05; h: 0.02; MOQ: AW = 1.45 PW, AW = 1.45 L. *Clypeus:* 0.50–10× diameter of ALE. *Legs:* All leg segments covered by flattened incised hairs. Femora with two dorsal spines, three long, rigid, ventral hairs. *Male palp:* (Figs. 14, 15). Tibia with one apophysis; median apophysis pointed, funnel shaped; embolus long, slender, subtegulum present.

Female.—Total length 2.45; carapace 1.22 long (1.22–1.47), 0.84 wide (0.84–0.91). *Color:* Carapace medium brown, with some darker striae in thoracic area. Cephalic lobe brown. Eye field dark brown. Chelicerae medium brown, fangs yellow, cheliceral lamina white, sternum pale brown, with darker margin, legs paler: femora brown, other leg segments yellow. Abdomen: dorsum dark sepia with pale circumferential folds, venter pale yellow, contrasting with dark sides. Branchial operculum yellow. *Carapace:* (Fig. 33). Slightly granulated, cephalic area raised, but not slanting back. *Abdomen:* Circumferential folds not conspicuous, modified hairs in front of spin-

Table 2.—Character statistics for consensus tree with length 24, ci 0.87 and ri 0.83.

Character	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
steps	1	1	1	2	1	1	2	1	3	2	2	2	2	2	2
ci (× 100)	100	100	100	100	100	100	100	100	100	50	100	50	50	50	100
ri (× 100)	100	100	100	100	100	100	100	100	100	50	100	0	66	0	100

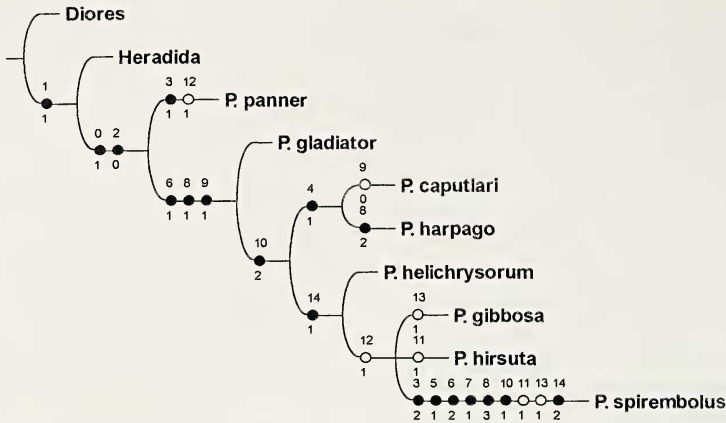


Figure 35.—Cladogram (calculated with Hennig86): strict consensus tree of two trees with length 24, consistency index 0.87 and retention index 0.83, (prepared with WINCLADA 0.99.9, Nixon 1999) under DELTRAN optimization. Numbers indicate characters (above branch) and states (under branch). Black circles: unique gains; white circles: homoplastic gains or reversals.

nerets fine and long. *Epigynum*: (Figs. 22, 29). With sclerotized, accolade-shaped line near posterior margin; internal structure complicated: with glandular organ, sperm ducts long and intricately wound. Spermathecae oval.

Distribution.—Only known from Namibia near 18°E, and between 24°–28°S.

CLADISTIC ANALYSIS

According to the cladogram presented in Jocqué (1991) *Palfuria* is part of an unresolved clade comprising several *Zodariinae* with femoral organ and a number of other characters (flattened leg setae, absence of leg spines, presence of patellar crack) which make this clade very robust. Among these, *Heradida* and *Palfuria* are the only genera with abdominal circumferential folds in at least some of the species. This is clear from the drawings in Jocqué (1987, fig. 4) which show the presence of these abdominal folds, a synapomorphy of *Heradida* and *Palfuria*. The fact that the genera share a large part of their distribution area further supports the assumption that *Heradida* is the sister-taxon of *Palfuria*. It is here used as one of the outgroups. The other one is *Diores* Simon 1893, which is the sister-group of the former clade plus *Acanthinozodium* Denis 1950. The following 15 characters were used to analyze the relationships among the species of *Palfuria*: 1: 'Cephalic lobe' [0] - not raised; [1] - raised; 2: 'Abdomen' [0] - without circumferential folds; [1] - with circumferential folds; 3: 'femoral organ' [0] - no deep alveolus; [1] - single mod-

ified hair in deep alveolus; 4: 'retrolateral tibial apophysis' [0] - simple, tapered, almost straight process; [1] - strongly curved process; [2] - with broad base, broadly fused to segment; 5: 'dorsal tibial apophysis' [0] - absent; [1] - present; 6: 'embolus' [0] - short, rigid; [1] - long, flexible; 7: 'origin of embolus' [0] - far in front on tegulum; [1] - on posterior part of T, base directed retrolaterad; [2] - on prolateral part of T, base directed backwards; 8: 'Tegular swelling near base of embolus' [0] - absent; [1] - present; 9: 'median apophysis' [0] - hook-shaped; [1] - slightly curved; [2] - bifid; [3] - complex; 10: 'subtegulum' [0] - small, invisible on unexpanded palp; [1] - large, visible on unexpanded palp; 11: 'epigynum' [0] - with poorly developed transverse ridge; [1] - with sclerotized transverse ridge; [2] - with plate; 12: entrance ducts' [0] - short (< 3x diameter spermathecae); [1] - long (> 3x diameter spermathecae); 13: 'atria' [0] - absent; [1] - present; 14: 'glandular organ' [0] - absent; [1] - present; 15: 'spermathecae' [0] - spherical; [1] - narrowed towards centre; [2] - longer than wide. The character-matrix is given in Table 1.

Trees were calculated with Hennig86 (Farris 1988) and command ie* and with NONA (Goloboff 1994) with mult*15. All characters were unordered and given equal weight. In both analyses this resulted in two trees of length 24, consistency index 0.87 and retention index 0.83. The only difference between these trees is the position of *P. gibbosa* and

P. hirsuta which are either the sister-group of *P. spirembolus* alone or of *P. spirembolus* together with the other one. The strict consensus tree ("nelsen") thus only collapses this terminal clade. This cladogram, as optimized under DELTRAN, is shown in Fig. 35 (prepared with WINCLADA, Nixon 1999). A number of non-informative characters (2, 4, 6 and 8) were included mainly because the males of three species are still unknown and at least some of these characters are likely to become informative when the missing sex is found. The only effect these characters have on the analysis is a slight increase of the consistency index which drops to 0.84 when these four characters are deactivated. The retention index remains stable.

DISCUSSION

As in many other genera in the family there is a large range of complexity in male palps and female epigyna. In the male palps this ranges from the basic situation with a simple dorsolateral tibial apophysis and a short, spine-shaped embolus (*P. panner*), to a tibia with at least two apophyses as in *P. gladiator* and *P. harpago*, often combined with a long, filiform embolus as in *P. spirembolus*. In the epigynum the range is from short-to-long entrance ducts with the addition of a well separated glandular organ of which the function is unclear. It is remarkable that, here again, the basal arrangement of the secondary genitalia is more reminiscent of the primitive situation in other genera than in the most derived members of *Palfuria* itself (Jocqué 1998). Revisions of the genera *Storena* Walckenaer 1805 (Jocqué & Baehr 1992), *Diores* Simon 1893 (Jocqué 1991), *Tenedos* O.P.-Cambridge 1897 (Jocqué & Baert 1996), *Asteron* Jocqué 1991 (Baehr & Jocqué 1996) have revealed that in each of these genera the somatic characters are very stable whereas there is a wide range in the complexity of the secondary genitalia.

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LITERATURE CITED

- Baehr, B. & R. Jocqué. 1996. A revision of *Asteron*, starring male palpal morphology (Araneae, Zodariidae). *Revue Suisse de Zoologie*. Vol. hors série I:15–28.
- Dippenaar-Schoeman, A. & R. Jocqué. 1997. African Spiders. An Identification Manual. Plant Protection Research Institute Handbook #9. 392 pp.
- Farris, J.S. 1988. Hennig86, ver. 1.5, Computer program distributed by its author.
- Goloboff, P. 1994. Pee Wee and NONA, version 2.15. Computer program distributed by its author.
- Jocqué, R. 1987. Descriptions of new genera and species of African Zodariidae with a revision of the genus *Heradida* (Araneae, Zodariidae). *Revue de Zoologie Africaine* 101:143–163.
- Jocqué, R. 1990. A revision of the Afrotropical genus *Diores* (Araneae, Zodariidae). *Annales du Musée Royal de l'Afrique Centrale* 260:1–81.
- Jocqué, R. 1991. A generic revision of the spider family Zodariidae (Araneae). *Bulletin of the American Museum of Natural History* 201:1–160.
- Jocqué, R. 1998. Female choice, secondary effect of "mate check"? A hypothesis. *Belgian Journal of Zoology* 128:99–117.
- Jocqué, R. & B. Baehr. 1992. A revision of the Australian spider genus *Storena* (Araneae, Zodariidae). *Invertebrate Taxonomy* 6:953–1004.
- Jocqué, R. & L. Baert. 1996. *Tenedos*, an early conquest of America. *Revue Suisse de Zoologie*. Vol hors série I:309–320.
- Jocqué, R. & A. S. Dippenaar-Schoeman. 1992. Two new, termite-eating *Diores* species (Araneae, Zodariidae) and some observations on unique prey immobilization. *Journal of Natural History* 26:1405–1412.
- Lessert, R. De. 1936. Araignées de l'Afrique orientale portugaise, recueillies par MM. P. Lesne et H.-B. Cot. *Revue Suisse de Zoologie* 43:207–306.
- Lessert, R. De. 1938. Araignées du Congo Belge (Première partie). *Revue de Zoologie et de Botanique Africaines* 30:424–457.
- Nixon, K.C. 1999. Winclada version 0.99.9. Program and documentation available from the author, Cornell University, Ithaca.
- Simon, E. 1910. Arachnoidea, Araneae (II). In L. Schultze (ed.), *Zoologische und anthropologische Ergebnisse einer Forschungsreise im westlichen und zentralen Südafrika*. *Denkschriften des medicinisch-naturwissenschaftlichen Gesellschaft zu Jenä* 16:175–218.

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